CASE STUDY #1

"A DAYLIGHTED ROOM"

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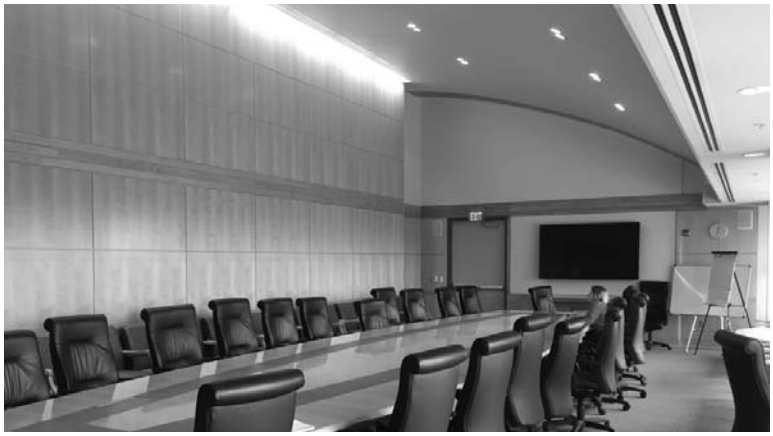
GARY MICHAEL BOARDROOM

- The Gary Michael Boardroom is located on the **3rd floor** near the north terrace of the **Albertson Building**. The space is primarily used to organize & conduct meetings for students, professionals, & faculty.

- The only daylighting system used is the large **glazing wall system** that makes up the north side of the boardroom. When the manual blinds cover the glazing wall for presentations, the room is dependent on the use of **electrical fluorescent lighting** that is washed down the south interior wall, & evenly dispersed **spot lighting**.

CURRENT LIGHT PERFORMANCE

- The only current daylighting scheme is the **glazing wall** that covers 32′ x 8′ of the north side of the room. It takes up most of the entirety of the wall, besides a 2′ x 8′ column placed in between the system.
- The glazing system includes mullions that break the glazing up into different sized openings, along with two sets of doors that open onto the terrace.
- The north side of the building receives a **decent amount of daylight**, but not enough to make the room always usable, especially during overcast days.
- To prevent **glare** during presentations on the main TV screens, manual blinds can be lowered to conceal the room.

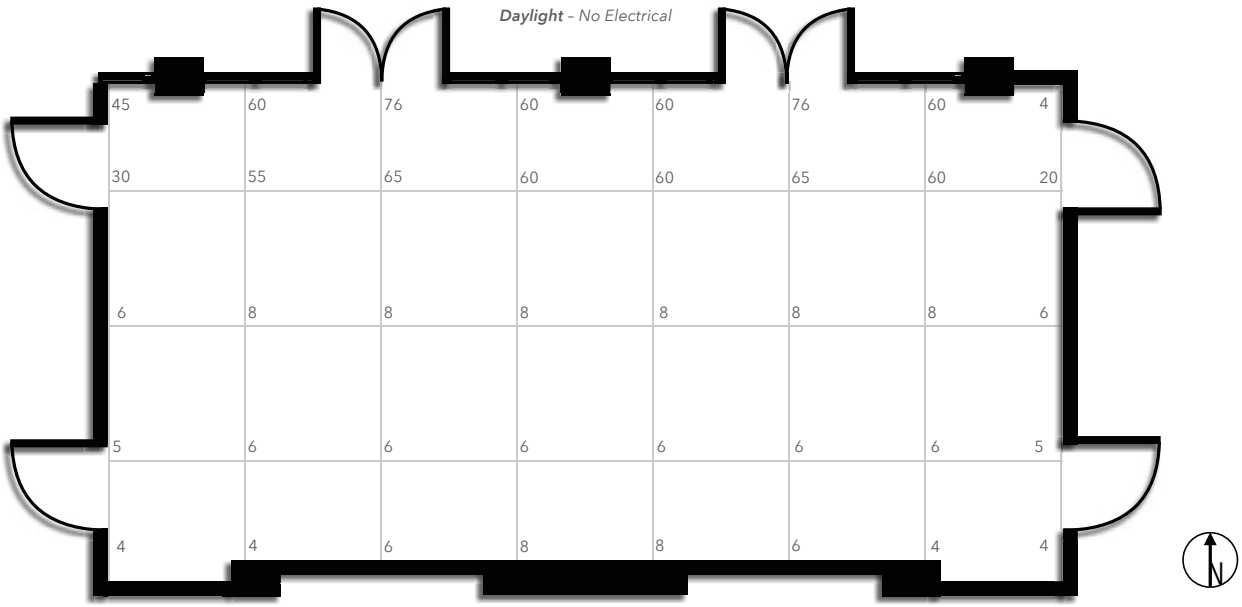


EXISTING PERFORMANCE ANALYSIS

Illuminance Footprint in FC

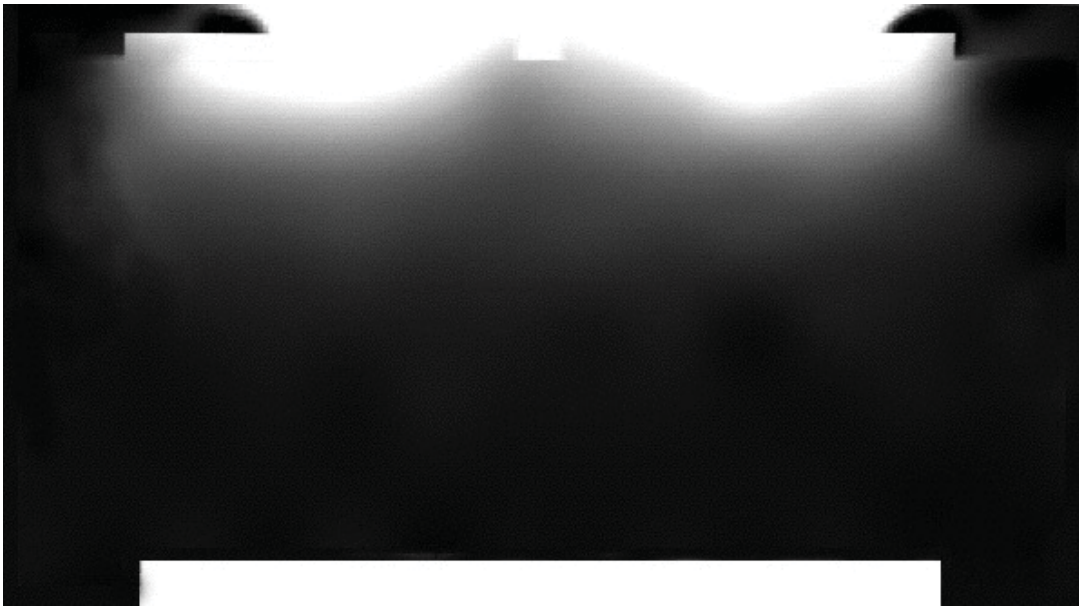
Taken 2/3/16 at 12:00PM

***Daylight** – No Electrical*



EXISTING PERFORMANCE ANALYSIS

*Using **Sefaira***



LIGHTING ZONES & PERFORMANCE

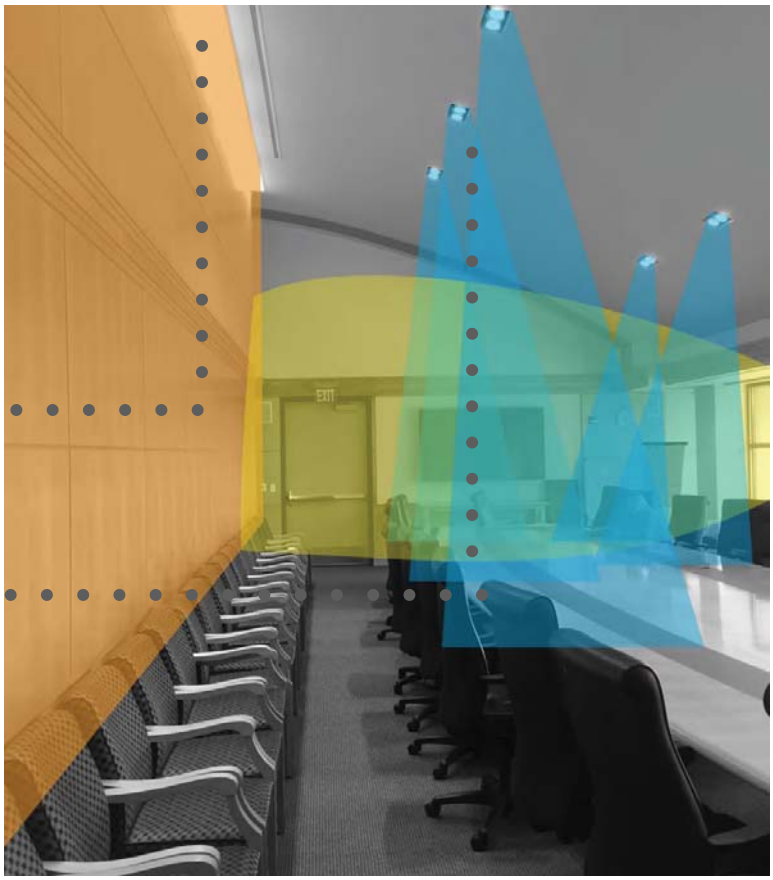
There are two types of electrical lights in the space:

- (16) 34W Compact Fluorescent Tube w/ Diffusers
- (33) 15W Dimming Compact Fluorescent Light Bulb

Daylight

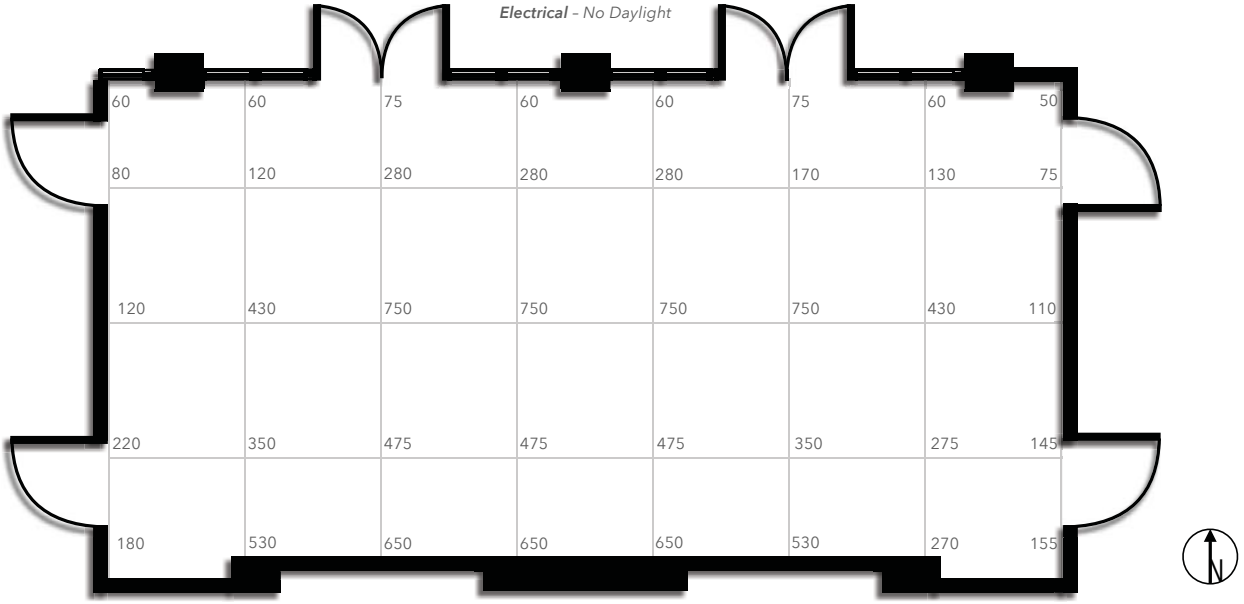
Light Washed Wall

Spot Lighting



EXISTING PERFORMANCE ANALYSIS

Illuminance Footprint in FC
Taken 2/3/16 at 6:00PM
***Electrical** – No Daylight*



ENERGY USAGE OF ELECTRICAL LIGHTING

- 34W Compact Fluorescent Tube w/ Diffusers (16 Total)
  kWh/day –> 0.27
  Cost Per Hour = 0.272
  Cost Per Day = 0.217
  Cost Per Year = 79.43

  (16 Bulbs x 32W) = **512W / Hour**

- 15W Dimming Compact Fluorescent Light Bulb (33 Total)
  kWh/day –> 0.12
  Cost Per Hour = 0.012
  Cost Per Day = 0.096
  Cost Per Year = 35.04

  (33 Bulbs x 15W) = **495W / Hour**

TOTAL

512W + 495W =

1007W / Hour

or…

1.007kW x 9 Hour/Day x 260 Days/Yr

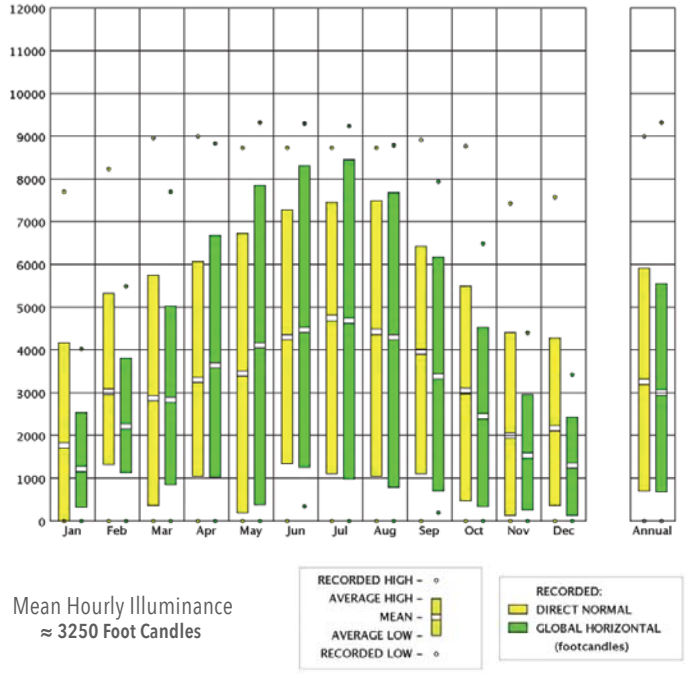
2356.4 kW / Year

MOSCOW, IDAHO CLIMATE

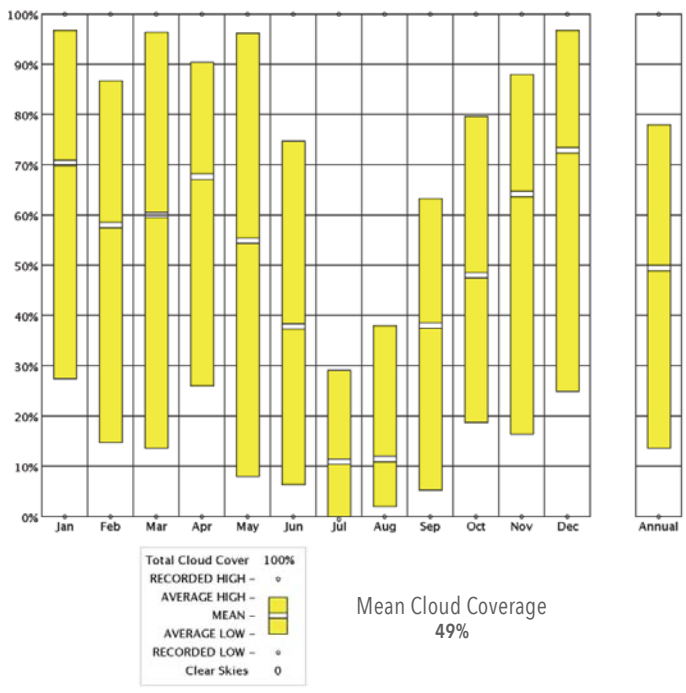
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Clear Days	8	8	7	7	7	7	10	10	10	10	5	6	95
PT Cloudy Days	7	7	7	8	9	10	12	11	8	7	6	6	98
Overcast Days	15	14	17	15	15	12	9	10	12	14	18	18	169
% Clear	27	28	23	23	23	24	32	32	33	32	17	20	26.16
% PT Cloudy	23	24	23	27	29	34	39	35	27	23	21	20	27.08
% Overcast	50	48	55	50	48	41	29	32	40	45	62	60	46.66

Predominantly Overcast Days

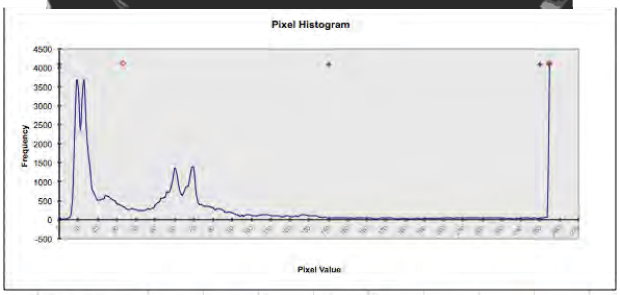
DAYLIGHT AVAILABILITY



Mean Hourly Illuminance
≈ 3250 Foot Candles



Mean Cloud Coverage
49%



Overall Image		Indiviual Pixel		
Weighted Ave Pixel Intensity	73.66	Individual Pixel Value	20	
Total Number of Pixels	76799	Corresponding Luminance	8.86	footlamberts
Background Bell Curve		**Spike**		
Low End Pixel Value	0	Low End Pixel Value	250	
High End Pixel Value	140	High End Pixel Value	255	
Background Median Value	33	Spike Median Value	255	

EXISTING GLARE ANALYSIS

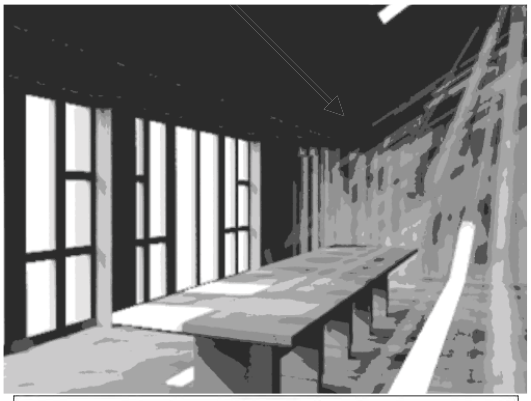
- Intensity of light from glazing isn't diffused evenly throughout the room
- Along southern interior wall is the darkest area of the room
- Reflective surfaces, such as the table, create unwanted glare
- Without protection from manual blinds, glare is a concern throughout the majority of the hours of operation

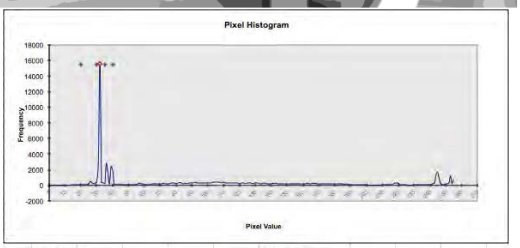
DESIGN PROPOSAL IDEAS

- Adding top lighting (skylights), because side lighting is not an option, in order to provide another light source into the space to help reduce glare
- Changing the southern wall from wood paneling to a light colored wall for a higher IRC, allowing for better distribution of lighting
- Consider changing large conference table furnishing to one with a less reflective surface
- Possibly changing some of the clear glazing on the curtain wall to diffused glazing, which would help reduce glare as well as internal heat gain

REDESIGN – ADDING TOP LIGHTING

REDESIGN ANALYSIS – USING SEFAIRA





Overall Image			Indiviual Pixel		
Weighted Ave Pixel Intensity	117.76		Individual Pixel Value	40	
Total Number of Pixels	76799		Corresponding Luminance	58.12	footlamberts
Background Bell Curve			**Spike**		
Low End Pixel Value	20		Low End Pixel Value	30	
High End Pixel Value	40		High End Pixel Value	35	
Background Median Value	32		Spike Median Value	32	
Number of Background Pixels	30724		Number of Spike Pixels	19738	
Background Percentage of View	40.01	%	Spike Percentage of View	25.70	%
Spike to Background Ratio					
Median Spike to Median Background	1.00	TO 1			
Schiler Glare ?	NO				

REDESIGN GLARE ANALYSIS

- Intensity of light **diffused more evenly**
- Southern interior wall has gained **more uniformity** in light distribution
- Glare on surfaces (large conference table) appears to be lessened
- According to the Excel file, there is **no longer glare** in the space

REDESIGN COMPARISONS

- The **original design** required electrical lights while in use for a total of 1.007 kW/Hour, resulting in approximately **2356.4 kW/Year**. (1.007W x 9 Hour/Day x 260 Days/Year = 2356.4 kW/Year)
- The **new design** requires electrical lights, with a total of 1.007 kW/Hour, only in very few circumstances (roughly one hour in 90 days of the year) resulting in only approximately **90.63 kW/Year**. (1.007W x 1 Hour/Day x 90 Days/Year = 90.63 kW/Year)
- This saves approximately **2265.8** kW/Year!

CONCLUSION

Any daylighting additions to this space will be an improvement, & by **adding another source of light** it will help reduce the glare problem.

Working with the existing glazing wall & adding **skylights** allows users to depend less on artificial lighting throughout the year.

However, glare could potentially still be an issue with the large conference table being such a highly reflective surface. Other considerations would be to use furniture with a **less reflective surface**.

The benefit of this space is that it is highly technological, & the existing manual blinds will help to **reduce glare** when there is an issue.

Annual Energy Savings Due to Daylighting:

65.6% to 66.2%

		Base	Case 1	Case 2
Enter LATitude of building location	LAT =	46.7	46.7	46.7
Enter the Daily Occupancy Period Code from box below (1-11):	DOPC =	4	4	4
1=7a3p, 2=7a4p, 3=8a4p, 4=8a5p, 5=8a6p, 6=8a7p, 7=8a8p, 8=9a5p, 9=9a6p, 10=9a7p, 10=9a8p, 11=9a9p				
Enter Typical Floor Width (ft):	FL =	21	21	21
Enter Typical Floor Length (ft):	FW =	43	43	43
Typical Floor Area (f) = FL * FW = FA =		903	903	903
Typical Floor Shape (Length ÷ Width) = FS =		2.047619	2.047619	2.047619
Enter Lighting Control Type (1 = on/off; 2 = dimming):	LCT =	1	2	2
Enter Design Illuminance Level (30, 50, or 70 fc) =	DIL =	70	70	70
Enter window area per floor above the workplane (sf)	WAAW =	0	256	256
Enter typical ceiling height above floor (ft)	CH =	10	10	10
Floor Perimeter (ft), FP =		128	128	128
Side-Lighting Glass Area Fraction = WAAW ÷ (CH * FP) = SLGAF =		0.000	0.200	0.200
Enter skylight or monitor glazed area (sf):		0	0	65
Top-Lighting Glass Area Fraction: glazed aperture area ÷ floor area = TLGAF =		0	1.107E-05	0.071982
Enter Side-Lighting Glass Visible Transmittance (0-0.8)	= SLGVT =	0	0.8	0.8
Enter Top-Lighting Glass Visible Transmittance (0-0.8)	= TLGVT =	0	0	0.8
Enter Well Factor (0.2 to 1.0; depends on well depth and reflectance)	WF =			
Enter Annual Hours of Occupancy (hr)	AHO =	2340	2340	2340
Enter Installed Lighting Load (watts/sf; typically 1.0 to 3.0)	ILL =	2.5	2.5	2.5
Electricity Cost ($/kWh; typically 0.10 to 0.25)	EC =	$0.15	$0.15	$0.15
Enter No. of Floors:	NF =	1	1	1
Enter daylighted width (ft; 15 is typ. for conventional windows)	DW =	0	15	15
Gross Total Building Area = NF * GAPF = GTBA =		903	903	903
Enter Non-Lighting Electric Load (watts/sf; 3.0 is typical for office buildings)		0.0	1.0	1.0
Peak Electric Utility Demand Rate ($/kW-month; 2.50 is typical for office bldgs):	PDR =	$1.70	$1.70	$1.70
Daylighted Hours (determined from DOS)		96.5%	96.5%	96.5%
Total Daylighted Area (% of total; based on entered depth for sidelit; 100% for top):	TDA =	0%	100%	100%
Control Effectiveness (determined by LCT, side or top-lighting, and DIL):		#DIV/0!	68%	69%
Enter Dimming Factor (0 - 1.0; typically 0.8 for dimming systems, 1.0 for on/off)	DF =	0	1	1
Annual Energy Savings Due to Daylighting		#DIV/0!	65.6%	66.2%